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Tomasz Adam Karkowski[1]
Department of Labor and Social Policy
Faculty of Economics and Sociology
University of Lodz
Dorota Karkowska[2]
Institute of Nursing and Midwifery
Faculty of Health Sciences, Collegium Medicum
Jagiellonian University in Krakow
Paweł Skoczylas[3]
University of Social Sciences, Poland

Just-in-Time Method in the Management of Hospital Medication Stock

Abstract: Lean management aims to add value to the patient and the healthcare unit by eliminating superfluous and non-value adding activities [Trela 2016, p. 235]. The purpose of the article is to discuss the implementation of *lean management/lean healthcare* solutions to the healthcare units thanks to the use of a value-adding *Just-in-Time (JiT)* method in hospital inventory management. The article is based on an up-to-date subject literature, and was conducted by means of *desk research* analysis.
Key words: hospital, just in time, value, patient, lean management.

Introduction

The frequently rescheduled improvement in the operating efficiency of hospitals and other units constitutes a long-term perspective for the healthcare sector, and is the optimum direction for changes, taking into account the limited funds and the prede-

[1] tomasz.karkowski@uni.lodz.pl
[2] Radca pawny, dorota.karkowska@uj.edu.pl
[3] pawel.skoczylas@interia.eu

termined revenue side of hospitals, where their financing is concerned. Management tools which offer an opportunity to enhance operating and cost efficiency include, for example, centralised purchasing functions, centralised support functions, or process optimisation by way of *lean management* [Trendy 2017].

Lean management in the healthcare sector is customarily known as *lean healthcare*. It was introduced in many healthcare units in various countries. However, our experience shows that only some of the tools and methods of *lean management* have been used to streamline selected areas of healthcare units activity, in particular hospitals. The cases of lean healthcare described in the available literature show that most frequently it is aimed at improving healthcare quality (adding value for the patient), increasing the availability of health services, streamlining organisation processes, or rationalising costs [Rydlewska-Liszkowska, pp. 282–283].

Lean management is a management concept that consist in maximizing the use of possessed resources. Its core ideas are reducing employees' activities, economical management, and eliminating unnecessary stoppages and bottlenecks in the organization. This concept requires, above all, the understanding of customers' needs and the identification of what constitutes for them an added value in a product or service. For an organization to focus on those needs it is necessary to define the value stream within its structure (all the activities that need to be done in order to deliver a ready product or service), and also the value stream in the entire supply chain (all the processes, correlations with business partners, external and internal suppliers, external contractors). Attaining customer satisfaction requires the elimination or at least reduction of unnecessary activities in the value chain for which the patient/customer doesn't want to pay [Wiśniewska, Konieczyńska 2011, p. 260].

Moreover, lean system is a method that allows hospitals to perfect healthcare quality through the minimization of errors and reduction of waiting time. It is a concept which may support doctors and other employees in that it eliminates obstacles and allows them to focus on those activities which are indispensable for treatment and care. It allows to enhance a long-term hospital organization by way of a reduction of costs and risk, increasing at the same time the opportunities of development and growth [Graban 2011, p. 2].

Examples of value-adding and non-value adding activities concerning medications

As far as 'lean system' method is concerned, it includes methods of defining which activities contribute to adding value (value-added, VA), and which ones do not (non-

value-added, NVA). According to the literature for an activity to be deemed value-adding it has to fulfil three conditions: first, the customer/patient has to have the willing to pay for this activity, second, the activity has to change the product or service in any way, and third, the activity has to be done correctly at the first try.

An example of a VA activity exercised by a pharmacists is preparing a medication according to a given formula, whereas an example of a NVA activity is re-processing of the medications that had been returned from the hospital wards. In the case of prescriptions, an example of a VA activity is preparing medicinal products, and an example of a NVA activity is repeated checks and verifications.

One of the most frequent types of waste in hospitals is overstocking medicinal products, which generates unnecessary costs due to their purchase, storing and transport, and also leads to their expiration, and consequently, to the need of their utilization.

Pharmacy is one of the hospital departments which dispenses ready-to-use or prepared on the spot medicines to internal customers (nurses and patients). An anticipated delivery of medicines may be considered as an overproduction, as hospital wards frequently return the surplus of medications to the pharmacy due to, for example, the discharge of the patient from the hospital or the modification of medical recommendations. This process can be streamlined in such a way so that the delivery of the medications be more frequent, which on the one hand will increase the number of transports, but on the other hand will minimize the amount of returns and the work connected with their processing.

It is important to bear in mind that medications stocks are not a waste by default – it is their surplus, which in turn leads to the freezing of hospital funds, or even their loss if the medications expire. Lean system should consist in drawing attention to the customers' and patients' needs, and in satisfying them maintaining the lowest level of stocks possible in a particular situation at the same time. Such situation may occur if we cooperate with suppliers which are capable of delivering medications within an adequate time.

Managing regular orders is not complicated as the products are usually delivered automatically, however, such system does not allow for flexible response to the changes in the amount of medicinal products in use. As those amounts may change both in hospitals and wards due to seasonality, changes in population or health trends, regular orders method requires overstocking in a situation when the demand decreases, or the other way round, causes a risk of product shortages when the demand increases. Reactions to the changes in demand are often delayed and inadequate to the situation. In the case of a shortage of a particular medicine, the employ-

ees have to devote additional time to order it, and the hospital bears additional delivery costs.

Medications kept at the nurse station are prescribed for particular patients, so the pharmacy should make the delivery in the Just-in-Time mode. If a doctor recommends the administration of a given medicine three times a day, a one-off delivery of a larger amount of medicinal products is not in the pharmacy's interest, because such a large delivery may, on the one hand, minimize the need to walk, but on the other hand may increase the risk of some medicines being no longer necessary due to the modification of doctor's recommendations, the transfer of the patient to a different ward or their discharge from the hospital. If the patient is transferred to a different ward within the same hospital, the medications are returned to the pharmacy, and then delivered once again to the new ward, which increases the waste of work, time and transport [Graban 2011, pp. 2–291].

Moreover, in line with the *lean* concept, various types of waste should be minimized. One of the types of waste are defects (lacks and errors), for instance, administration of a wrong medicine, or administration of a correct medicine but in a wrong dose. In view of the above-mentioned issues, the aim of streamlining activities in lean hospital is the elimination of errors which can be avoided and which pose a threat to the patient's health and life. Besides, the leaders of lean management are aware that the success does not depend only on the level of technological development and qualified expertise, but also on the support given by the employees and the organizational efficiency of the entity. Lean hospital is designed in such a way as to minimize waste which bothers both the patients and the employees [Graban 2011, pp. 288–291].

Kanban and Just-in-Time

The essence of Kanban method lies in such organising the service process that each organizational cell provides services according to the current demand.

Kaizen techniques, which are meant to continuously improve all processes, draw special attention to the issues related to the performance of all the tasks 'just in time', and to the whole system related with the supply chain. The Just-in-Time method, on the other hand, is a stock management strategy that aims at obtaining return on investment by reducing the stocks both in the storage system and the production process. JiT strategy is closely related with Kanban system, which correlates inventory, production line demand and the customer's expectations. The entity should not produce such amounts as to fill the warehouses, but should organise itself in such a way so that the product be delivered to the customer in the shortest time possible.

JiT system can lead to great benefits, bringing returns on investment costs sustained by the company, and also can increase quality and efficiency. At the same time it is very demanding for the suppliers. In JiT system it is necessary to set up an inventory monitoring system and determine minimal levels of stocks so that the production process does not stop. This system requires an excellent cooperation with the suppliers of materials and resources. If the stocks level is drawing near the minimal value, the purchase procedure is initiated and the stocks rebuilt. Thanks to such solutions we minimize warehouse space and storage costs [Łazicki, Lewandowski 2011, pp. 105–106].

What is more, *Kanban* system means managing the flow and production just in time. If the process does not receive the order to perform a task, it does not do it. In this system the quality is controlled at every stage, and the costs are decreased by limiting the stocks and defective parts. Kanban allows to make the production more flexible. You can manufacture only so many products as the customer has ordered. In this way the overproduction is eliminated, and the production costs decrease. The essence of Kanban is a simple signalling system that informs about the demand for a specific task (production, transportation). In Japanese the word Kanban means a signal or a sign. Usually this signal is in the form of a card, but it can also be empty space/field or an empty container. This solution is often used in the regulation of material/intermediate products supply on the working post. There are many types of signals and they are not clearly established. Each entity can choose its own mode of signalling, which will work well in its type of production. However, it is vital to remember that the signalling system has to be understandable to all the employees.

Kanban system is also a system of information, as well as a system of planning, distributing and controlling activities and production tasks. Kanban is simple and effective, and thanks to the visualisation of communication it eliminates numerous errors that occur in many fields of the value stream. Normally, in information systems that control stocks the information about inventory level doesn't agree with the real situation; Kanban system is a remedy that eliminates the problem and ensures that the information is always up-to-date. Even though Kanban is a simple system, its implementation entails a high risk. You can have a perfectly planned project and not be able to carry it out, because, for example, the employees will have a negative attitude to the changes, the demand will be subject to considerable fluctuations, the seasonability of production has not been taken into account, or there was no clear-cut policy towards the suppliers (punctuality, quality, lot size etc.) [Łazicki, Lewandowski 2011, pp. 143–145].

Kanban is a system of signals used in performing particular tasks at different stages of product manufacturing (when the patient needs another healthcare service, in what organization part of the entity, what human and material resources have to be used). Creation of an uninterrupted web of relations between particular groups of employees or organization cells of the healthcare unit and the establishment of principles of close cooperation as well as a system of communication are pre-requisites for the implementation of signalling system. A particularly useful approach to patient management is considering the course of actions as an inseparable whole (successive stages of value creation), which is a condition for determining the accumulated value (the final health effect) of particular healthcare services (medical procedures) provided for them. The premise lies in the cooperation between particular organization parts of the entity and abandoning the habit of perceiving healthcare services provided by each organization cell as final or not related to the final effect for the patient [Rydlewska-Liszkowska, p. 281].

The use of Just-in-Time method in healthcare units

Just-in-Time method is used to streamline the return on investment by way of reducing the level of stocks in the production and storage processes, which has a direct influence on the decrease of costs. It is achieved thanks to the use of Kanban technique, which keeps informed about the material consumption and stock supplies, as well as controls the orders. This strategy allows to minimize the warehouse surface. Nevertheless, it is vital to stress that this technique is difficult to manage. Material consumption trends have to be monitored, and the supplies forecast. Statistical tools for analysis and forecasting come in handy. JiT strategy enforces complete synchronisation, cooperation and trust between the entity and its business partners [Łazicki, Lewandowski 2011, pp. 84–85].

Supply of materials used directly in the hospital treatment is the starting point for the construction of the added value expected by the patient, i.e. the healthcare service because of which they go to hospital.

One of the most frequent forms of medication warehouse management is the so-called virtual warehouse: a hospital resigns from its own warehouse, signs a suitable agreement with a supplier (manufacturer or pharmacist wholesaler) and obliges it to supply specific medications within a very short period of time. It even occurs that some pharmacist wholesalers, having received data form the hospital (e.g. treatment plans prepared for each patient individually), are capable of preparing and supplying a set of medications packed individually for each patient, along with their identifica-

tion (e.g. a bar code), name, surname, type of ward and date of delivery. Such solutions, already popular in Western European countries, are also gaining popularity in Poland. They provide hospitals with an opportunity to eliminate or significantly reduce pharmacy departments or ward warehouses which are frequently too extensive, and, moreover, they offer unprecedented quality of medication distribution in individual packaging. Such solutions also allow for considerable savings in medication purchases, because medications are bought according to the amount of pills, and not in collective packages (which often are delivered to hospitals in greater amounts than to general pharmacies). In economics such solution is known as Just-in-Time method, and as far as an efficient monitoring of possessed resources is kept, it allows to order subsequent resources only after reaching a pre-set minimum level [Karniej 2013].

It is important to bear in mind that stock and finance management are a special factor that influences the financial liquidity of an entity in market economy. Stock management requires a multilateral knowledge of both logistics and financial aspects. Having excessive financial assets tied up in inventory leads to the creation of lost benefits costs, which restrain long-term development of the entity, whereas stock shortages may disturb the continuity of healthcare services. Managing healthcare entity's stocks should include determining the optimal amount of stocks depending on demand; the evaluation of stock costs broken down into the costs included in current account and the hypothetical costs that allow to solve issues related to determining stock level in an entity [Sierpińska, Wędzki 2001, p. 52, Mioduchowska-Jaroszewicz 2010, p. 194] (for raw and other materials – Baumol model[4], for other supplies – two variables graph based on the so-called buffer stock scheme, which is determined based on historical data of consumption and delivery time) and JiT system.

Material and medications management are those areas where JiT model is used in healthcare sector, employment being yet another important area. It should be pointed out that many entities have tired to solve its human resources problems by way of JiT technique. For example, hospitals redesigned its nursing departments according to the patient-oriented concept, which includes making use of different skills of various employees [Aptel, Pomberg, Pourjalali 2009, p. 5].

The problem of stock management in healthcare entities, in particular hospitals, is very significant. It is being estimated that an average hospital in Poland manages ca. 130,000 medicinal products and 95,000 medical devices. In order to streamline stock turnover and avoid keeping excessive stock levels(assuring at the same time proper

[4] It s a classical model of assets management. According to its main principles the company receives regular and periodical cash inflows, and spends them at a continual and fixed pace [W. Baumol (1952), *The Transactions Demand for Cash: An Inventory Theoretic Approach*, "Quarterly Journal of Economics", November, p. 545–556, as cited in: G. Michalski, *Model Baumola*, http://michalskig.ue.wroc.pl/mspmzsp.pdf).

functioning of the hospital), the entity can introduce logistics solutions used generally in other fields of economy. In many hospitals there are pharmacy modules, which facilitate the automatisation of medicinal products management. If medicinal products are additionally marked with a bar code, scanning them first in the central pharmacy and then on the ward enables the control of medicine stocks in the entire entity (even in the ward pharmacies). If there is not a bar code system, the role of nurses increases – they introduce data manually, minimizing thus the cases of expiration or loss of medications and controlling stock level.

The purchase of medications indicated in the healthcare entities' formulary has to be done in compliance with Public Procurement Act[5]. However, the result of the procurement depends to a great extent on the preparation of bid specification. For example, preparing bid specification in such a way that each medication is a separate bid package contributes significantly to an increase in the number of offers, which in turn increases the probability of obtaining the lowest price. Director of one of the SPZOZ (Independent Public Health Care Unit) hospitals in Poland points out that thanks to this solution the price of each medication dropped several percentages, sometimes even over 10%. Some products turned out to be even 50–60% cheaper.

Hospitals take various actions in order to decease the level of financial assets tied up in inventory. In some hospitals the warehouse is taken on consignment, and in this way the risk of stock management is transferred onto an external entity. Workgroups on antibiotics policy are set up in hospitals and internal restrictions on the medications in use are introduced, in line with the principle 'the lowest cost – the highest therapeutic effect', which draws attention to the need of achieving both social and financial target of the healthcare unit [Raulinajtys-Grzybek 2013, p. 38].

Pharmotherapy is one of the most basic elements of treatment. The number of medicines administered to the patients depends on the reasons for their hospitalisation, health status or chronic comorbidities [Religioni 2016, p. 11].

For instance, in case of a diabetic patient it is important to ensure a sufficient stock of insulin and needles, avoiding at the same time unnecessary overstocking which entails additional costs. Also, it is an important source of information for the hospital which can aid with throughput rate. Continuous quality care that the patient receives ensures they are more likely to be discharged form hospital quickly. Thanks to the development of technology, nowadays many hospitals use electronic charts [Li 2015, p. 10].

[5] Act of 29 January 2004 – Public Procurement Act (unified text: Dziennik Ustaw [Journal of Laws] of 2015, item 2164).

What is more, the organisation of ward warehouses is often chaotic, as the same product can be available in different locations. Thus, incorrect administration leads to an inadequate utilisation of space (it is crucial to point out that space is essential for hospitals and should not be occupied by superfluous supplies). In this case an adequate rotation and utilisation of the hospital material is not guaranteed, and in the result many medications pass their expiration date, whereas other resources become redundant. What is more, a typical way of organising materials in cupboard or on shelves leads to a LIFO *(Last In First Out)* phenomenon. It is the opposite of a more adequate procedure called FIFO *(First In First Out)*.

Firstly, it is vital to differentiate between ordinary products (frequently used and cheap) and special products (rarely used and frequently expensive), as they follow distinct supply paths. In a situation when the nurses consider it necessary to order ordinary materials (e.g. syringes, lattice gloves, electrolytic solutions etc.) they send the order to the central warehouse, which stores all the products, and if the stock level there is below the Point of Reorder, they call the external suppliers. In turn the procedure for special materials (e.g. prosthesis, dilatators etc.) is different as the order is sent to external suppliers by the wards, and the central warehouse is only controlling the 'transit' of the ordered products [Battini, Rafele 2008, p. 376].

Summary

The lean concept, which until now has been used in production companies, is nowadays frequently introduced to service entities, for example healthcare units, both those which are business entities and those which are not, which contributes to streamlining some processes, minimizing operational costs and increasing patients satisfaction.

This solution is based on the JiT Kanban method, and includes the use of a movable 'card' as well as a set of double-sided baskets and organiser cupboards. The whole system is very simple. Each stock unit receives a manual Kanban. When the stock unit is used, the move card is brought to the hospital's central warehouse from where a new stock unit is sent to the ward. [Battini, Rafele 2008, p. 390].

The main idea of the JiT management system is avoiding the overstocking; the inventory should be delivered at the adequate time and to the right place. The JiT is thought to be something more than just a tool to reduce inventories in companies. It is a comprehensive philosophy aimed at eliminating waste and any non-value adding elements [Li 2015, p. 2].

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